Mumps Outbreak United States, 2006

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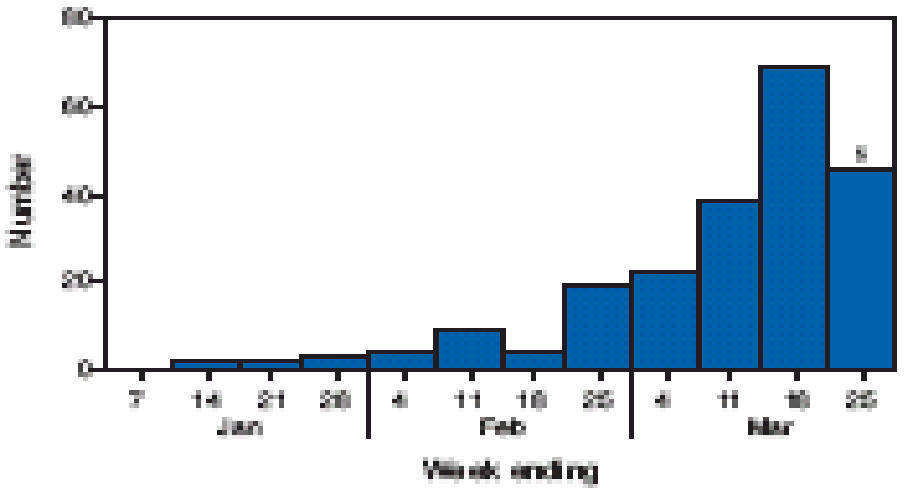
Mumps Epidemic — Iowa, 2006

In the United States, since 2001, an average of 265 mumps cases (range: 231–293 cases) have been reported each year,* and in Iowa, an average of five cases have been reported annually since 1996.† However, in 2006, by March 28, a total of 219 mumps cases§ had been reported in Iowa, and an additional 14 persons with clinically compatible symptoms were being investigated in three neighboring states (11 in Illinois, two in Nebraska, and one in Minnesota) in what has become the largest epidemic of mumps in the United States since 1988 (*1*). This report summarizes and characterizes the ongoing mumps epidemic in Iowa, the public health response, and recommendations for preventing further transmission.

Mumps is an acute viral infection characterized by fever and nonsuppurative swelling of the salivary glands; an estimated 20%–30% of cases are asymptomatic. Complications can include inflammation of the testicles or ovaries, meningitis/encephalitis, spontaneous abortion, and deafness. During the prevaccine era, nearly everyone in the United States experi-

FIGURE 1. Number* of mumps cases,† by week of onset — Iowa, 2006



*N = 219.
†Includes confirmed, probable, and suspect cases. Case definitions were modified from Council of State and Territorial Epidemiologists/CDC mumps

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Update: Multistate Outbreak of Mumps — United States, January 1–May 2, 2006

CDC and state and local health departments continue to investigate an outbreak of mumps that began in Iowa in December 2005 (*1*) and involved at least 10 additional states as of May 2, 2006. This report summarizes preliminary data reported to CDC from these 11 states and provides recommendations to prevent and control mumps during an outbreak.

Cases of mumps are reportable through the National Notifiable Diseases Surveillance System (NNDSS) (*2*). NNDSS reports are transmitted electronically to CDC each week and include information on individual cases such as age, sex, date of symptom onset, vaccination status, and complications of illness. Mumps cases included in this report are those with onset from January 1 (*MMWR* week 1) through April 29 (*MMWR* week 17) that were reported to CDC as of May 2 through NNDSS (or the Iowa mumps outbreak-specific reporting system) from Iowa and 10 additional states that reported one or more cases of mumps epidemiologically linked to the multistate outbreak. In addition to cases reported through NNDSS, to provide information rapidly during this outbreak, states have been reporting aggregate numbers of mumps cases and mumps-related hospitalizations and complications biweekly to CDC. Cases reported in this manner through May 2, 2006, also are included in this report.

During January 1–May 2, 11 states reported 2,597 cases of mumps. Eight states (Illinois, Iowa, Kansas, Missouri, Nebraska, Pennsylvania, South Dakota, and Wisconsin) reported mumps outbreaks with ongoing local transmission or clusters of cases; three states (Colorado, Minnesota, and Mississippi) reported cases associated with travel from an outbreak state. The majority of mumps cases (1,487 [57%]) were reported from Iowa; states with the next highest case totals were Kansas (371), Illinois (224), Nebraska (201), and Wisconsin (176) (Figure 1). Of the 2,597 cases reported overall, 1,275 (49%) were classified as confirmed, 915 (35%) as probable, and 287 (11%) as suspect; for 120 (5%) cases, classification was unknown. Twelve mumps viral isolates from six states were characterized; all were mumps genotype G.

For 2,067 (80%) of the 2,597 mumps cases with patient age available, the median age was 21 years (range: <1 year to 96 years). In the eight states with outbreaks, the incidence rate was highest among persons aged 18–24 years (17.1 per 100,000 population), followed by persons aged 5–17 years

FIGURE 1. Number* of reported mumps cases linked to multistate outbreak, by state — United States, January 1– May 2, 2006

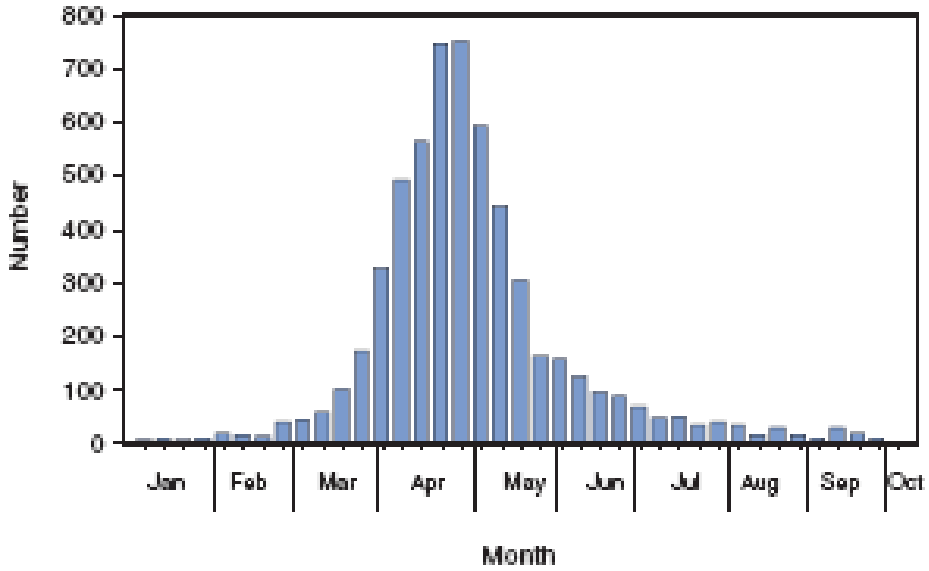
Brief Report

Update: Mumps Activity — United States, January 1–October 7, 2006

During January 1–October 7, 2006, a total of 45 states* and the District of Columbia reported 5,783 confirmed or probable mumps cases to CDC (Figure). This includes 2,597 cases previously reported by 11 states during January 1–April 29, 2006 (*1*). This report summarizes the epidemiology of mumps cases in the United States during 2006. With low levels of reported mumps continuing, health-care workers should remain alert to suspected mumps, conduct appropriate laboratory testing, and use every opportunity to ensure adequate immunity, particularly among populations at high risk for mumps.

Cases of mumps are reportable through the National Notifiable Diseases Surveillance System (NNDSS). Reports are transmitted electronically via NNDSS to CDC each week and include individual case information such as age, sex, date of symptom onset, vaccination status, and complications of illness. Mumps cases included in this report are those with onset from January 1 (week 1) through October 7, 2006 (week 40).

FIGURE. Number of mumps cases,* by month of onset — United States, January 1– October 7, 2006



*Provisional number of cases (N = 5,783) as reported to the National Notifiable Diseases Surveillance System.

(7%) were unvaccinated; 245 (14%) had received 1 dose of measles, mumps, and rubella (MMR) vaccine, and 884 (49%) had received ≥2 doses of MMR vaccine. The vaccination status of 546 (30%) patients, the majority of whom were adults, was unknown (*3*).

Among the 5,783 cases for which week of onset are known,

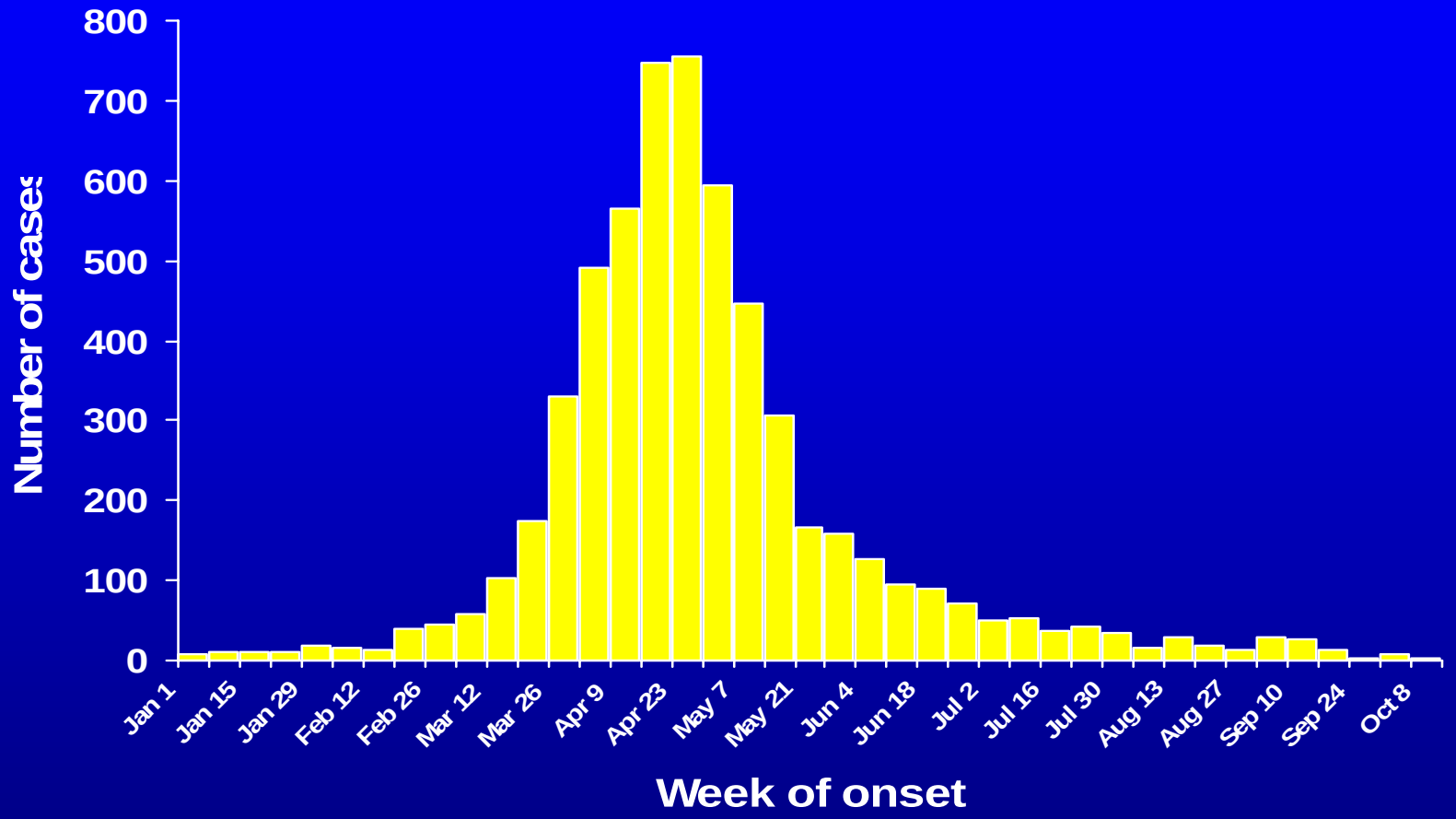
Outline

- Update epidemiology of outbreak
- Lessons learned / Questions still unanswered
- Future considerations

Sources of Mumps Data

- National Notifiable Disease Surveillance System (NNDSS)
  - January 1st – October 14th
- Databases from 7 states with most cases (provisional data)
  - IA, KS, IL, WI, NE, SD, MO
  - January 1st- July 31st

Week of Onset for Mumps Cases, United States, January 1 – October 14, 2006 (n=5824)[1]



[1] National Notifiable Diseases Surveillance System (data provisional)

Mumps Outbreak, United States, 2006
January 1 – October 14, 2006 (n=5824)[1]

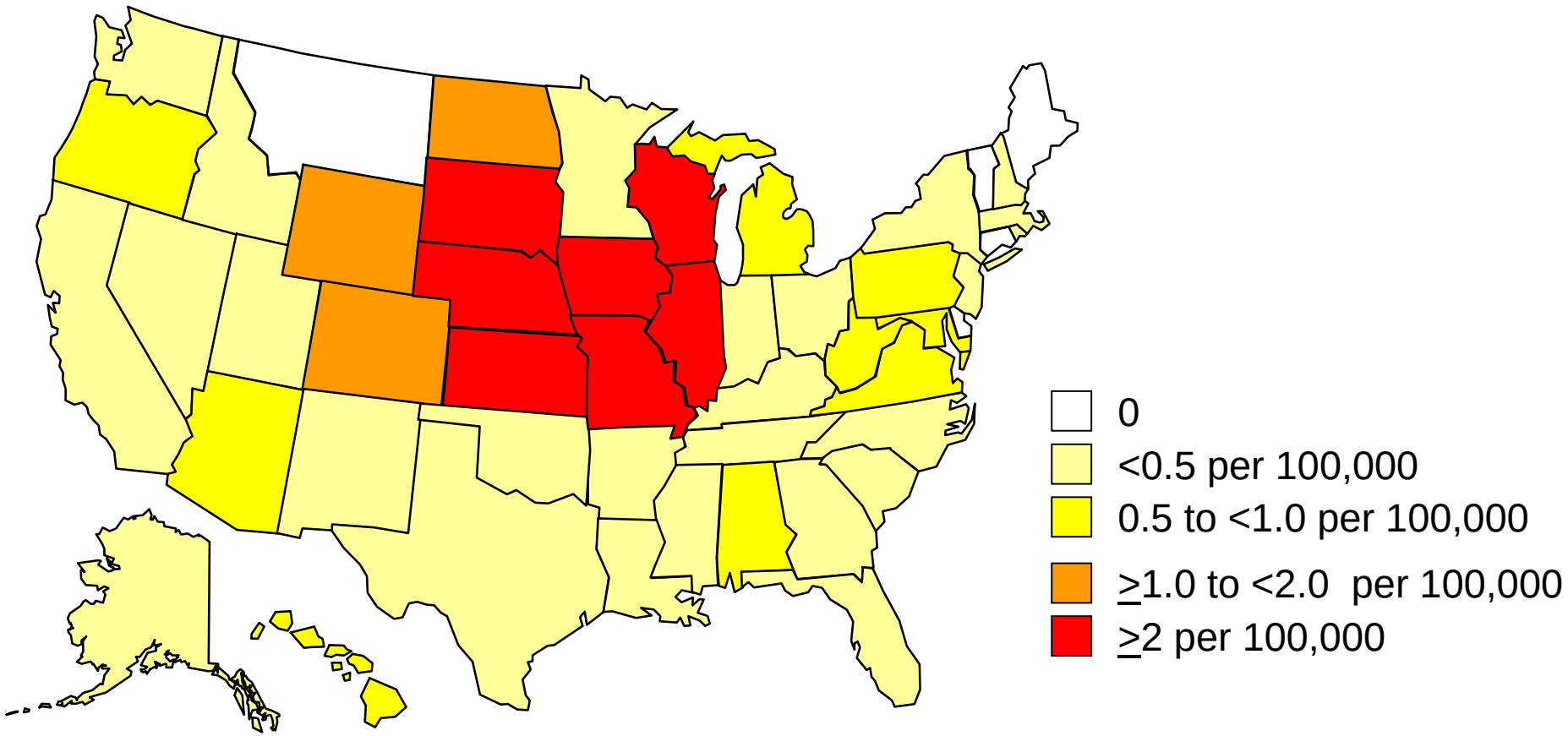
- Number of cases reported per state[2] 1-1971
- Number of states reporting ≥1 case 45

Number of cases	Number of states
1-5	17
10-49	18
50-99	3
≥ 100	7

- States reporting ≥ 100 cases
  - IA, KS, IL, WI, NE, SD, MO

[1] Reported through the National Notifiable Diseases Surveillance System (NNDSS) (data provisional)
[2] Among states reporting at least one case

Incidence of Mumps by State, United States, January 1 – October 14, 2006 (n=5824)



CDC Immunization

Number and Incidence of Mumps in the Seven Highly Affected States, January 1- October 14, 2006[1]

State	Reported Cases	Incidence/100,000
Iowa	1971	67
South Dakota	288	37
Kansas	914	33
Nebraska	360	20
Wisconsin	751	14
Illinois	591	5
Missouri	168	3
	(87%)	

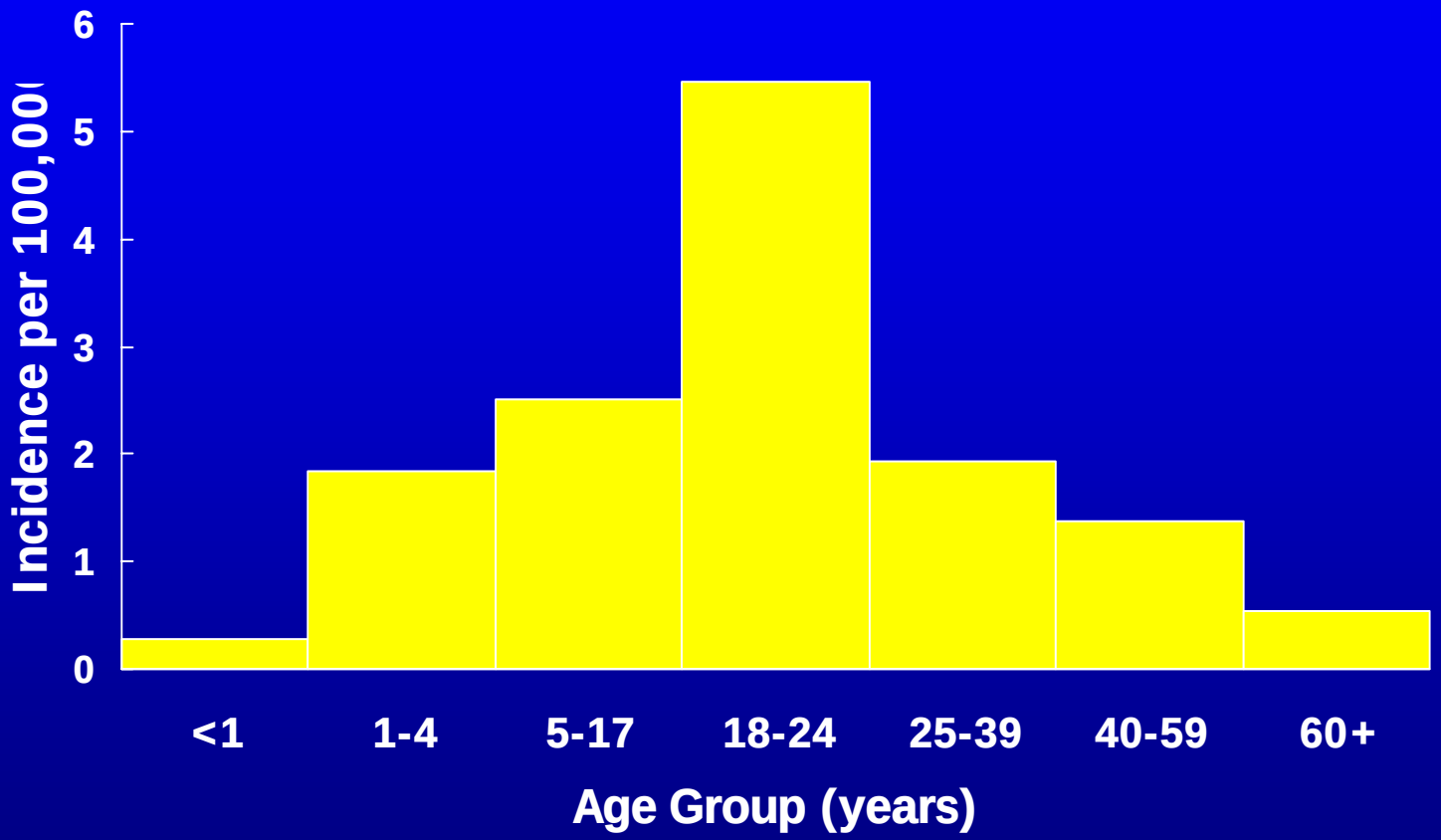
[1] National Notifiable Diseases Surveillance System (data provisional)

Demographics – Mumps Outbreak
United States, January 1 – October 14, 2006[1]

Gender (N=5778)	Female	3666 (63%)
Race (N=4782)	Native American	56 (1%)
	Asian	94 (2%)
	African American	228 (5%)
	White	4321 (90%)
	Other	83 (2%)
Ethnicity (N=4439)	Hispanic	296 (7%)
	Non-Hispanic	4143 (93%)
Median Age (N= 5786)	22 years	Range <1-96 years

[1] Reported through the National Notifiable Diseases Surveillance System (NNDSS) (data provisional)

Incidence of Mumps by Age Group, United States January 1 – October 14, 2006 (n=5786)[1]



[1] National Notifiable Diseases Surveillance System (data provisional)

Reported Manifestations Among Mumps Cases Highly Affected States, January 1-July 31st[1] n= 4538

Manifestation	Percent
Parotitis	68%
Orchitis[2]	~ 6%
Meningitis	0.5 %
Encephalitis	0.3%
Deafness	0.3%
Hospitalization	~ 2%
Death	0
Oophoritis[3]	0.7
Mastitis[3],	0.7
Pancreatitis	2 cases

[1] IA, KS, IL, WI, NE, SD, MO reported by the states (data provisional)

[2] Among males

[3] Among females

Mumps outbreak 2006

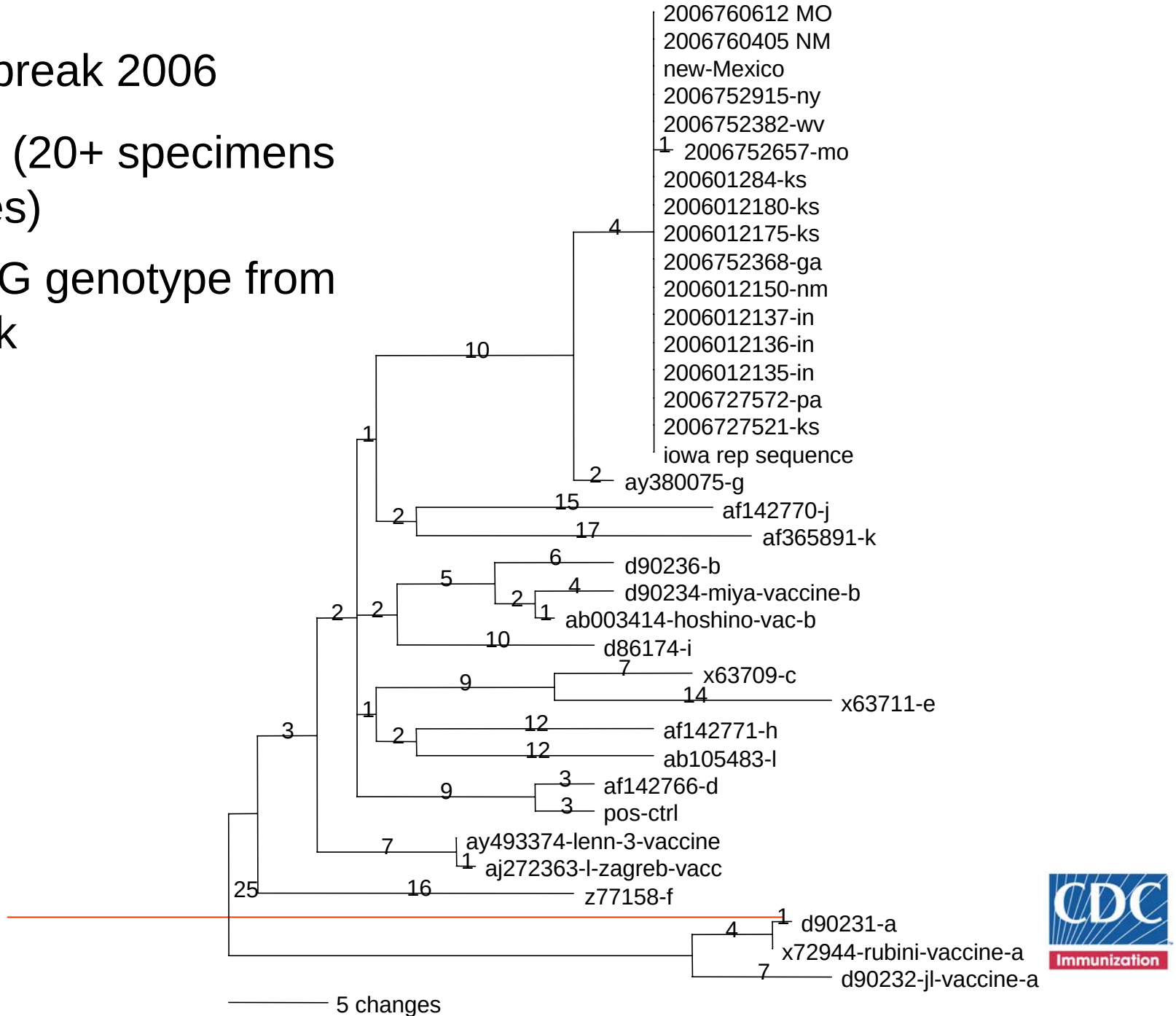
G genotype (20+ specimens from 9 states)

Identical to G genotype from UK outbreak

Dendogram

6-21-06

SH gene



Vaccination Status of Reported Mumps Cases January 1- July 31, 2006[1] N=4538

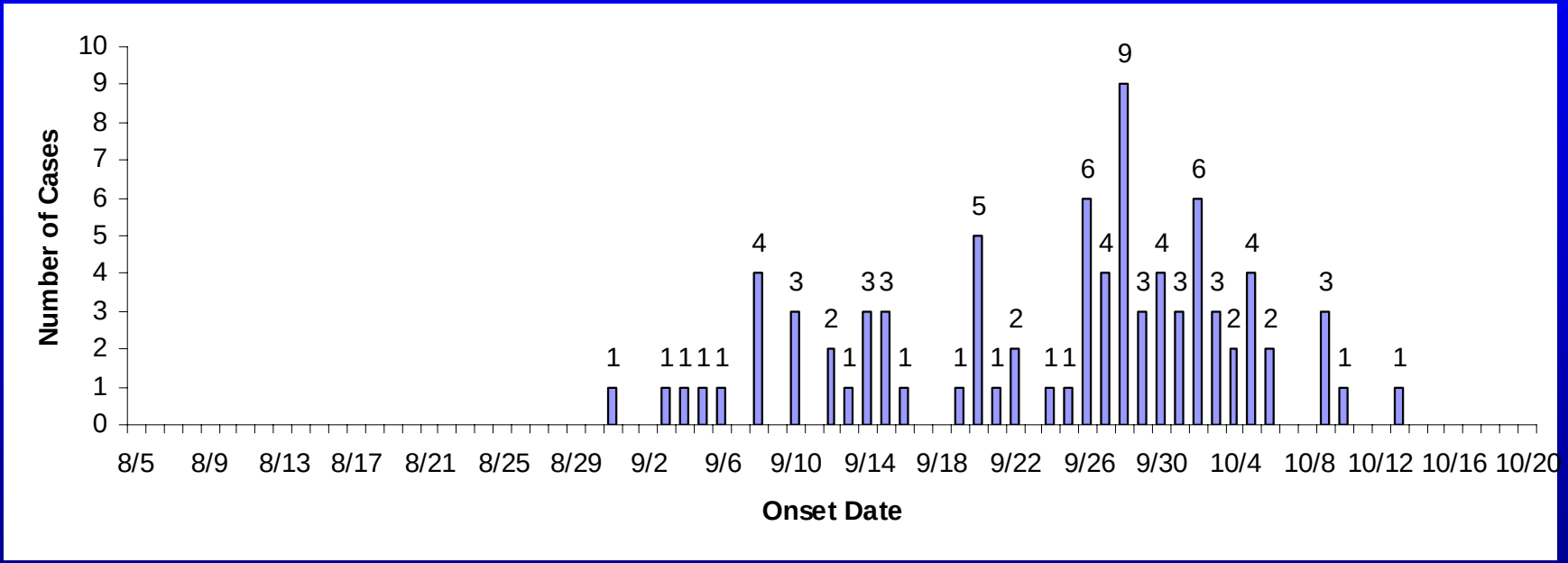
Unvaccinated	4%
1 dose	20%
2 doses	46%
3 doses	1%
Unknown (majority adults)	30%

[1] IA, KS, IL, WI, NE, SD, MO reported by the states (data provisional)

Mumps Cluster in a College IL August-October 2006

- IL N=85
  - Onset dates 8/31-10/13/06
  - Age 17-30 years
  - Lab IgM 10 positive 31 negative
    PCR 7 pos, 45 negative
  - Vaccination history
    - 0 doses: 2 (2%)
    - 1 dose: 1 (1%)
    - 2 doses: 79 (93%)
    - 3 doses: 3 (3%)
  - Complications
    - 1 orchitis, 1 myocarditis

Mumps Cluster in a College, Illinois, August-October 2006



Mumps Clusters in 2 Colleges KS, VA August-October 2006

- KS N=22
  - Onset dates 8/7-9/22/06
  - Age 18-24 years
  - Vaccination history
    - 1 dose: 1 (5%)
    - 2 doses: 21 (95%)
- VA N=24
  - Onset dates 9/22-10/23/06
  - Age 18-22 years 1 HCW
  - Vaccination history
    - 2 doses: 23 (96%)
  - Complications 1 aseptic meningitis

Lessons Learned: Epidemiology

- Few infants affected, few school or day care outbreaks reported, no spread to unvaccinated populations
- Cases with mild clinical presentation among vaccinated persons may have delayed recognition of cases
- Congregate settings facilitated transmission

Epidemiology: Unanswered Questions

- Why females were more affected?
- Why did the outbreak start in IA?
- Why were incidence rates highest in Iowa?

Lessons Learned: Laboratory Diagnosis

- Laboratory diagnosis in vaccinated cases is challenging
  - IgM testing
    - Varied performance of IgM tests
    - IgM response may not occur or may be delayed
  - IgG testing requires 2 specimens
    - Acute specimen positive
  - Viral detection: RT-PCR low yield, higher when specimen is taken early in the course of disease
- Ruling out cases on basis of negative lab results is difficult

Laboratory Diagnosis: Unanswered Questions

- What are the kinetics of serologic response among vaccinated individuals?
- What are the true correlates of immunity?
- If IgG, is there a protective IgG level of antibody titers?

Lessons Learned: Surveillance

- Adequacy of surveillance before outbreak?
- Cases without parotitis/mild clinical presentation
  - Inadequate case report form
- Inadequacy of clinical case definition

  Illness with acute onset of unilateral or bilateral tender, self-limited swelling of the parotid or other salivary gland, lasting 2 or more days, and without other apparent cause
  - No classification for cases with complications without parotitis with negative lab results
  - No classification for asymptomatic confirmed cases

Surveillance: Unanswered Questions

- Was mumps virus circulating endemically?
- Were mild-symptomatic cases not detected by the surveillance system before the outbreak?
- Were cases in vaccinated persons ruled out by negative lab tests?
- During the outbreak, were mild-symptomatic cases overdiagnosed because of enhanced surveillance?

Lessons Learned: Vaccine Effectiveness

- Studying vaccine effectiveness in settings with high 2 dose vaccine coverage is difficult
  - Attack rates in 2 highly affected college campuses [Iowa] (case definition parotitis, orchitis, culture + or submand/mental swelling)
    - 2.0% (college where 97% students 2 vaccine doses)
    - 3.8% (college where 77% students 2 vaccine doses)
  - Attack rates in students who lived in dormitories approximately twice AR in students who did not live in dormitories

Vaccine Effectiveness: Unanswered Questions

- Can we prevent future mumps outbreaks with the current MMR vaccine?
- Can mumps be eliminated using the current MMR vaccine?
- Would a 3rd dose of MMR be useful for outbreak prevention?

Lessons Learned: Waning Immunity/Neutralization

- Preliminary data does not seem to show that waning immunity plays an important role

- Cross neutralization studies- no evidence of genetic drift or mutations giving rise to vaccine escape

Waning Immunity Unanswered Questions

- Is IgG a good correlate of immunity?
- If so, what are protective levels of immunity?
- What is the role of CMI?

Lessons Learned: Outbreak Control

- Intervention strategies limited in settings of high 2 dose coverage
- Isolation guidance
  - Viral shedding seems to be unlikely after 3 days of onset of symptoms

Outbreak Control Unanswered Questions

- Is isolation useful for mumps control?
- Are dormitories “transmission enhancers”?

Why did this outbreak occur?

- Unrecognized importation(s)?
- Delayed recognition outbreak
  - Physicians not familiar with clinical illness and vaccine modified disease
  - Some early cases ruled out with negative IgM
- College settings
  - High transmission potential
  - Lower 2 dose vaccine coverage than schools
  - Poor adherence to isolation guidance
  - Not feasible to truly isolate in dormitory settings

Why did this outbreak occur?

- 2 doses and ~ 90%-95% vaccine effectiveness may result in accumulation of susceptible persons sufficient to sustain transmission and a sizeable outbreak on a periodic basis

- Contribution of waning immunity?

However

- High MMR vaccine coverage levels and vaccine effectiveness likely prevented thousands of additional mumps cases (9 out of 10 exposures that may have resulted in infection in 2 dose vaccine recipients prevented)
- Incidence relatively low
- Disease appeared to be modified with lower rates of complications and hospitalizations

Next Steps…Future Considerations

- Improve surveillance
  - Develop better case-definitions and case report forms
- Improve laboratory diagnosis
  - Understand kinetics of immune response including CMI
  - Development of new lab tests?
- Develop adequate guidelines for isolation in colleges
- Review effectiveness of current vaccines and policy

Acknowledgements

- State and local health departments
- Council State Territorial Epidemiologists
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- American Academy of Pediatrics
- Advisory Committee on Immunization Practices
- CDC National Center Immunization Respiratory Diseases
  - Division Viral Diseases
    - Epidemiology branch
    - MMR HV lab branch
  - Immunization Services Division
  - Office Preparedness Emergency Response
- CDC DEOC, BPRP, DGMQ, DHQP

Division Bacterial Diseases
Global Immunization Division
Office Communications

Thank You